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Indian Standard

GUIDE FOR THE DETERMINATION OF THE AROMATIC HYDROCARBON CONTENT OF NEW INSULATING OILS

PART 2 INFRA-RED SPECTROPHOTOMETRIC METHOD

UDC 621·315·615·2 : 543·42 : 547·21

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Indian Standard

GUIDE FOR THE DETERMINATION OF THE AROMATIC HYDROCARBON CONTENT OF NEW INSULATING OILS

[PART 2 INFRA-RED SPECTROPHOTOMETRIC METHOD

0. FOREWORD

0.1 This Indian Standard (Part 2) was adopted by the Indian Standards Institution on 22 December 1986, after the draft finalized by the Liquid and Geseous Dielectrics Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 This standard is being brought out as a guide for determination of the aromatic hydrocarbon content of new insulating oils.

0.3 This standard is being brought out in two parts. Part 1 covers the adsorption chromatogaphic method for the determination of aromatic hydrocarbon content in new insulating oils.

0.4 In the preparation of this standard, assistance has been derived from IEC Pub 590 (1977), 'Determination of the aromatic hydrocarbon content of new mineral insulation oils', issued by the International Electrotechnical Commission (IEC).

0.5 Determination of olefinic plus aromatic hydrocarbon for petroleum and its products that are substantially free from butanes and butenes, that have 90 percent distillation not over 315°C and determination of aromatics in the aviation gasolines, etc, by gas chromatography has been covered in IS : 1448 [P : 104]-1981* and IS : 1448 [P : 48]-1978†.

0.5.1 This method as a quality control and acceptance test for new insulating oils determines the proportion of the total carbon atoms present in aromatic ring structures. The conversion factor derived from this relationship is applicable to oils with a molecular mass in the range of 290 to 500 and with an aromatic carbon content in the range of 1·2 to 60 percent.

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*Methods of test for petroleum and its products, [P : 104] Aromatics in light naphthas and aviation gasolines by gas chromatography.

†Methods of test for petroleum and its products [P : 48] Olefines and aromatic content (*first revision*).

0.6 New insulating oils are covered by IS : 335-1983*.

0.7 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960†. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard (Part 2) describes the method of determination of the aromatic hydrocarbon content of new insulating oils by infrared spectrophotometric test methods.

1.2 The infra-red absorption spectrum of the sample to be recorded and the adsorption characteristic of the aromatic ring at 1 610 cm^{-1} is measured. This absorption is a function of the amount of aromatic carbon.

1.3 This method is suggested as a quality control and acceptance test for insulating oils. It uses the relationship between the absorbance at 1 610 cm^{-1} and the n-d-M analysis to determine the proportion of the total carbon atoms present in aromatic ring structures. The conversion factor derived from this relationship is applicable to oils with a molecular mass in the range of 290 to 500 and with an aromatic carbon content in the range of 1·2 to 60 percent.

2. TERMINOLOGY

2.0 For the purpose of this standard, the definitions given in IS : 335-1983*, in addition to the following shall apply.

2.1 Infra-red Spectrophotometric Analysis — It uses the relationship between the absorbance at 1 610 cm^{-1} and the n-d-M analysis.

3. APPARATUS

3.1 Infra-red Spectrophotometer — Double beam spectrophotometer having a resolution better than 3 cm^{-1} in the region of 1 600 cm^{-1}.

3.2 Cell — Any infra-red liquid cell with variable or fixed path length with NaCl windows. The path length will comprise between 0·05 and 0·30 mm, and shall be known ±0·003 mm or better.

3.2.1 The most suitable length will be dictated by the content of aromatic hydrocarbons which is to be determined.

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*Specification for new insulating oils (*third revision*).

†Rules for rounding off numerical values (*revised*).

3.2.2 The path length can be determined by any procedure described in any handbook supplied by the manufacturer of spectrophotometer.

4. TEST METHOD

4.1 Adjust the spectrophotometer in accordance with the instructions given in the manufacturers handbook of spectrophotometer. Measure the transmitted intensity at 1 610 cm^{-1} using as a baseline, the tangent to the spectrum curve at the minima of this absorption band (*see* Fig. 1).

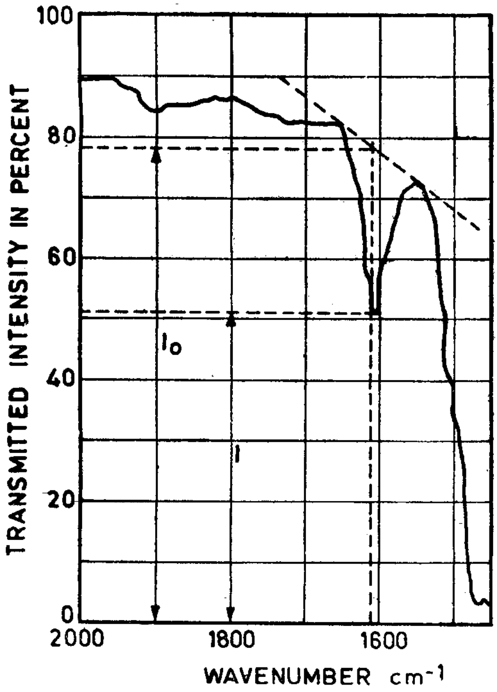

Fig. 1 Typical Infra-red Spectrum to Determine Aromatic Hydrocarbon Content

4.2 Results

4.2.1 Calculate the aromatic carbon content using the formula:

$$\text{Percent CA} = 1{\cdot}2 + 9{\cdot}8 \frac{\log_{10} I_o/I}{S}$$

where

S = cell path length, in millimetres;

I_0 = Intensity of incident rediation; and

I = intensity of transmitted rediation.

4.3 Reports

4.3.1 The following criteria should be used for the judging the acceptability of results (95 percent confidence).

Repeatability (*r*) : Duplicate results by the same operator should be considered suspect if they differ by more than the amount given in the following table.

Reproducibility (*R*) : The results submitted by each of two laboratories should be considered suspect if the two results differ by more than the amount given in the following table.

Aromatic carbon Content (CA)	5 percent ≤ CA ≤ 60 percent	1·2 percent < CA < 5 percent
Repeatability	5 percent	20 percent
Reproducibility	10 percent	25 percent